

REMARKS

Support For Amendment

The amendment to Claims 1-4, 8-10, 12 and 24 is supported by the specification, page 5, last line to page 6, line 4. Claim 24 has also been placed in independent form. Other amendments to the claims correct grammatical errors. No new matter has been added. Upon entry of this amendment Claims 1-18 and 24-26 are present and active in the application.

Request for Reconsideration

Applicants would like to thank Examiner Lee for the courteous and helpful discussion held with Applicant's representative on February 12, 2003. During this discussion it was noted that Takahashi, et al. measures friction in a polishing process to determine the end point of planarization, while the present invention calculates the time necessary to reach the end point of planarization.

Chemical mechanical polishing (CMP) is a recognized process for making the upper surface of a dielectric on a semiconductor device planar. In a typical CMP process a wafer is subject to an initial polish for an estimated amount of time such that the thickness does not go below a targeted value. The resulting thickness of the layer is then measured, and using this measured thickness and the initial polishing time, a polish rate is calculated. Finally, the wafer is polished for time that is calculated to achieve the desired final thickness based on the polish rate.

This process has disadvantages, mainly due to the manual estimates and calculations that are required. Inconsistent thickness targeting can lead to poor process control. It is difficult to account for other parameters which affect the CMP, such as incoming dielectric thickness pattern density, removal rate, and pad hours. Thus, it is difficult to track the overall process to determine the source of errors. The present invention mitigates these problems.

As now claimed, the present invention includes calculating a polish time sufficient to planarize a layer. This allows for controllably targeting the thickness of a layer by making use of the recognition that the polishing time of a layer has two primary

components: (i) the time necessary to planarize the layer, and; (ii) the time necessary to reduce the thickness of the planarized layer.

The rejection of the claims under 35 U.S.C. § 102 over Takahashi, et al., or under § 103 over Takahashi, et al. in view of Lofaro or Maekawa, is respectfully traversed. Takahashi, et al. determines an end point of planarization by monitoring friction during the polishing process, rather than calculating the time necessary for polishing.

Takahashi, et al. describes a method and apparatus for determining the end point during a polishing process. The frictional force between the semiconductor wafer and the polishing cloth is monitored, and decreases as the polishing process progresses (column 4, lines 55-58). When the frictional force becomes relatively stable the surface has been polished flat (column 4, lines 58-61). There is no description of calculating the time necessary to planarize a layer on a semiconductor substrate.

Lofaro has been cited for showing that in a conventional CMP process, the removal rate for polishing the layer needs to be adjusted according to pattern density and the composition of the layer. Maekawa has been cited for teaching that the Cpk value has been monitored in CMP processes, and controlled to at least one. Neither of these references describes calculating a first polish time sufficient to planarize a layer on a semiconductor substrate.

The present invention includes calculating a first polish time sufficient to planarize the layer on a semiconductor substrate. Takahashi, et al. determines an end point by measuring friction during the polishing process. Lofaro and Maekawa have been cited for limitations in dependent claims. The applied references do not suggest calculating a first polish time sufficient to planarize a layer. Applicants submit that the claimed invention is neither anticipated by, nor obvious over, the applied references, singly or in combination. Withdrawal of these grounds of rejection is respectfully requested.

The objection to the specification is respectfully traversed. The term "oxide metal 1" is the name of an oxide layer over a first metalization layer. If the Examiner feels that this is still a typographical error, applicants respectfully request that the Examiner

contact the undersigned and this term will be amended. Withdrawal of this ground of objection is respectfully requested.

The rejection of the claims under 35 U.S.C. § 112, second paragraph, has been obviated by appropriate amendment. The claims have been clarified. Withdrawal of this ground of rejection is respectfully requested.

Applicants submit the application is now in condition for allowance. Early notice of such action is earnestly solicited.

Respectfully submitted,



Paul E. Rauch, Ph.D.
Registration No. 38,591
Attorney for Applicants

SONNENSCHN NATH & ROSENTHAL
P. O. BOX 061080
WACKER DRIVE STATION, SEARS TOWER
CHICAGO, IL 60606
(312) 876-8000

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